Abstracts of Technical Articles from Bell System Sources

Barkhausen Effect II. Determination of the Average Size of the Discontinuities in Magnetization.[1] R. M. BOZORTH and J. F. DILLINGER. When the magnetic field-strength acting on a ferro-magnetic material is changed, the magnetization changes discontinuously (Barkhausen effect). These discontinuous changes have been examined in 1 mm. wires; an expression is derived and experimental arrangements are described for determining their average size for a given material in a given state of magnetization.

Experimental determinations of the average size have been made for iron (including a single crystal and a hard-drawn wire), nickel, and several iron-nickel alloys (permalloys). The average size is greatest on or near the steepest part of the hysteresis loop. The greatest average size, expressed as the volume of material the magnetization of which must be changed from saturation in one sense to saturation in the opposite sense to produce the same change in magnetization, is much the same for all of the materials examined, the extremes being 1.2×10^{-9} cm.^{3} for annealed iron and 45×10^{-9} cm.^{3} for 50 per cent nickel permalloy. This shows that the sizes of the discontinuities do not depend to any considerable extent on the size or kind of crystals.

Criticism is made of previous work on the size of the coherence region, the region within which the change in magnetization is confined. Although the effect of a single discontinuity in magnetization may be detected as far as 10 cm. from its source because of the eddy-currents induced, the experimental evidence is consistent with the view that the permanent change in magnetization is confined to the volume in terms of which the size of the discontinuity is measured as stated above, always less than 10^{-5} cm.^{3}.

Particle Size as a Factor in the Corrosion of Lead by Soils.[2] R. M. BURNS and D. J. SALLEY. In order to determine that part which particle size plays in the corrosion of lead by soils, lead specimens were buried in sands (generally inert in character) of various particle sizes and were maintained for periods of time ranging from 8 days to 5 months at 40° C. in a closed system in which the humidity and the composition of the atmosphere were controlled.

[1] *Phys. Rev.*, Apr. 1, 1930.
[2] *Ind. and Engg. Chem.*, Mar., 1930.

It has been shown that lead is corroded by contact with moist inert sands in the presence of air, and that the rate of attack is increased by increasing within certain limits the particle size of the sand, the moisture content of the sand, and the oxygen content of the atmosphere.

Corrosion is caused by oxygen concentration cells which are set up as a result of the partial or complete exclusion of oxygen at the points of contact of metal and soil.

Soil particle size influences the rate of corrosion by determining the extent of the electrode areas, and therefore the degree of cathodic polarization, of these oxygen concentration cells.

Reverberation Time in "Dead" Rooms.[3] CARL F. EYRING. With the advent of radio broadcasting and sound pictures very "dead" rooms have been built, and the significant problem of just how much reverberation should be used in broadcasting and recording presents itself. The direct measurement of reverberation time or its calculation by the aid of a reliable formula, then, is an important aspect of applied acoustics. A reverberation time formula enables one to calculate the reverberation time once the volume, surface area and average absorption coefficient of the surface of the room are known; or if the reverberation time is measured it enables one to calculate the average coefficient of absorption of the surface treatment. A correct reverberation time formula is, therefore, much to be desired.

Theories of reverberation leading to Sabine's reverberation time equation have been given by W. C. Sabine (1900), Franklin (1903), Jaeger (1911), Buckingham (1925). Recently Schuster and Waetzmann (1929) have pointed out that Sabine's formula is essentially a "live" room formula and they have shown as we also show that the reverberation time equation varies somewhat with the shape of the room. The present paper presents an analysis based on the assumption that image sources may replace the walls of a room in calculating the rate of decay of sound intensity after the sound source is cut off, which gives a form of reverberation time equation more general than Sabine's; it points out the difference between the basic assumptions leading to the two types of formulæ; it adds experimental data which support the more general type; and it ends with the conclusion that no one formula without modification is essentially all inclusive.

The Provision of Radio Facilities for Aircraft Communication.[4] E. L. NELSON and F. M. RYAN. This subject is discussed by the authors from the viewpoint of the radio engineer. The periods of fundamental

[3] *Jour. Acou. Soc. Amer.*, Jan., 1930.
[4] *Soc. Auto. Engs.*, Mar., 1930.

study and development of apparatus are stated to be drawing to a close, and we are said to be well advanced toward the third and last period—that of general application to commercial flying.

The discussion of radio-communication outfits is based on aircraft equipment recently developed by the Bell Telephone Laboratories for receiving weather reports and beacon signals and for two-way telephonic communication between the airplane and ground stations.

Units of different types of apparatus for use in small mail-planes and in large transports are illustrated and described, together with tabular data of sizes and weights of individual units of both general types of outfit.

Information regarding the requirements of shielding, bonding and installation is given, and the airplane factory is stated to be the place where provisions for radio installation can best be made. If suitable provisions have been made therefor, the installation of two-way radio equipment is said to be simple and inexpensive.

A number of the larger air-transport organizations have made noteworthy progress toward providing suitable radio systems and the Department of Commerce is giving much assistance in the way of radio aids to air navigation, but a great deal of work remains to be done by the industry as a whole and numerous problems will require solution. New requirements will be encountered as the number and size of airplanes increase, but continuing radio studies promise that the development of aircraft radio communication will keep abreast of the development of airplanes.

Transmission Characteristics of a Short-Wave Telephone Circuit.[5] R. K. POTTER. A method of observing and recording the audio-frequency transmission characteristics of a short-wave radiotelephone channel is described. These characteristics undergo rapid changes. They appear to be the result of wave interference between signals arriving at the receiver over paths of different group or electrical length possibly combined with the distortion produced by a progressive change in the angle of rotation of the polarization plane with frequency over the signal band. The persistence of certain pattern shapes during the observation periods and the changes in these shapes from hour-to-hour suggest that they are the result of progressive rather than erratic disturbances in the transmission medium. Times when the audio-frequency characteristics were flat were very rare. However, a consider-

[5] *Proc. Inst. Radio Engineers*, Apr., 1930.

able departure from flatness may occur without serious effect on the intelligibility of the speech transmission.

Synthetic patterns used in the analysis of the characteristics are explained and illustrated. Types of audio-frequency distortion resulting from selective fading are discussed. The effect of frequency or phase modulation in producing distortion on such a circuit is considered.

Records are shown of the effect of an automatic gain control, following carrier amplitude variations, upon the audio-frequency transmission characteristic. "Rapid" fading records revealing unlike fading on radio frequencies separated by 170 cycles are included. The seasonal variation in susceptibility of the circuit to this "rapid" fading is illustrated.

The records mentioned above are for ordinary modulated carrier transmission and involve the results of interaction between the two side bands in the detection process. There are also shown records made on single side-band carrier-suppressed transmission. In this case detection does not modify the frequency-amplitude relations and the record delineates directly the frequency-amplitude characteristics of the received radio-frequency band.

Age Hardening Lead-Calcium Alloys.[6] EARLE E. SCHUMACHER and GEORGE M. BOUTON. The lead end of the system lead-calcium has been investigated and a constitutional diagram given. A peritectic reaction has been discovered and the solid solubility of calcium in lead has been determined for five temperatures. The solubility changes from 0.1 per cent calcium at 328.3° C. to approximately 0.01 per cent calcium at 25° C. Data for locating the solid solubility curve were obtained from thermal analysis, electrical conductivity measurements, microscopic examinations and age hardening studies.

It has been shown on the basis of laboratory tests that greater tensile strengths and resistances to fatigue failure can be developed in some of the lead-calcium alloys than in the lead—1 per cent antimony alloy. Certain lead-calcium alloys have been suggested as sheathing materials for electrical cables.

Preparation of Air of Known Humidity and Its Application to the Calibration of an Absolute-Humidity Recorder.[7] A. C. WALKER and E. J. ERNEST, JR. An apparatus is described whereby constant flowing mixtures of air and water vapor may be prepared, in which the moisture content varies not more than 0.001 per cent by volume, over

[6] *Metals & Alloys*, Mar., 1930.
[7] *Ind. and Engg. Chem.*, Apr. 15, 1930.

long periods. This apparatus has been utilized to calibrate a sensitive humidity recorder capable of continuously recording atmospheric humidities up to 2.9 per cent by volume of water vapor in air (equivalent to about 95 per cent relative humidity at 25° C.) with a sensitivity of 0.0016 per cent by volume (0.05 per cent relative humidity at 25° C.). The use of the recorder in connection with the constant humidity apparatus is described and certain typical data illustrating the performance are given.